What is claimed is:

1. A wavelength conversion device which converts an excitation light pulse with central wavelength λ_S into light pulses with central wavelength λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number), comprising:

an SC (supercontinuum) light generation portion, onto which the excitation light pulse of central wavelength λ_S is incident, and which generates SC light having a spectral shape distributed over the range from wavelength λ_L to wavelength λ_H (where $\lambda_L<\lambda_H$); and,

an optical wavelength filter which filters the SC light, and the transmission central wavelengths of which are λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number); and

wherein the following conditions (1) and (2-1), (2-2), ..., (2-n) between the wavelength λ_L, the wavelength λ_H, the wavelength λ_S, and the wavelengths λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number) are satisfied.

$$\lambda_L < \lambda_S < \lambda_H \quad (1)$$

$$\lambda_L < \lambda_1 < \lambda_H \quad (2\text{-}1)$$

$$\vdots$$

$$\lambda_L < \lambda_n < \lambda_H \quad (2\text{-}n)$$

2. The wavelength conversion device according to Claim 1, wherein said SC light generation portion is an optical fiber having a characteristic such that the absolute

value of the wavelength dispersion at the wavelength λ_s decreases in the propagation direction.

3. The wavelength conversion device according to Claim 1, wherein said optical wavelength filter has a transmission characteristic such that the shape of the transmitted light spectrum is equivalent to the spectral shape obtained by a Fourier transform of the temporal waveforms of light pulses the central wavelengths of which are λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number).

4. The wavelength conversion device according to Claim 2, wherein said optical wavelength filter has a transmission characteristic such that the shape of the transmitted light spectrum is equivalent to the spectral shape obtained by a Fourier transform of the temporal waveforms of light pulses the central wavelengths of which are λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number).

5. The wavelength conversion device according to Claim 3, wherein said optical wavelength filter has a transmission characteristic such that the light transmissivity is represented by a Gaussian function, with the wavelength as an independent variable.

6. The wavelength conversion device according to Claim 4, wherein said optical wavelength filter has a transmission characteristic such that the light transmissivity is represented by a Gaussian function, with the wavelength as an independent variable.

7. The wavelength conversion device according to Claim 3, wherein the transmission bandwidth Δf (Hz) of said optical wavelength filter satisfies the following condition (3):

$$\Delta f = f_h > 0.44 f_0 \qquad (3)$$

where f_h (Hz) is the full width at half-maximum on the time axis of converted light pulses of wavelengths λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number), and f_0 (Hz) is equivalent to the frequency (bit rate) giving the frequency of appearance of light pulses on the time axis.

8. The wavelength conversion device according to Claim 4, wherein the transmission bandwidth Δf (Hz) of said optical wavelength filter satisfies the following condition (3):

$$\Delta f = f_h > 0.44 f_0 \qquad (3)$$

where f_h (Hz) is the full width at half-maximum on the time axis of converted light pulses of wavelengths λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number), and f_0 (Hz) is equivalent to the frequency (bit rate) giving the frequency of appearance of light pulses on the time axis.

9. The wavelength conversion device according to Claim 5, wherein the transmission bandwidth Δf (Hz) of said optical wavelength filter satisfies the following condition (3):

$$\Delta f = f_h > 0.44 f_0 \qquad (3)$$

where f_h (Hz) is the full width at half-maximum on the time axis of converted light pulses of wavelengths λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number), and f_0 (Hz) is equivalent to the frequency (bit rate) giving the frequency of appearance of light pulses on the time axis.

10. The wavelength conversion device according to Claim 6, wherein the transmission bandwidth Δf (Hz) of said optical wavelength filter satisfies the following condition (3):

$$\Delta f = f_h > 0.44 f_0 \qquad (3)$$

where f_h (Hz) is the full width at half-maximum on the time axis of converted light pulses of wavelengths λ_1, λ_2, λ_3, ..., λ_n (where n is a natural number), and f_0 (Hz) is equivalent to the frequency (bit rate) giving the frequency of appearance of light pulses on the time axis.

11. The wavelength conversion device according to Claim 1, comprising an optical amplifier in the incident optical path of said SC light generation portion of said excitation light pulse, the optical amplifier amplifying the peak power of the excitation light pulse to the optical intensity level necessary for generation of SC light.

12. The wavelength conversion device according to Claim 1, wherein said optical wavelength filter is a transmission wavelength-variable filter, the transmission light central frequency of which can be varied.

13. The wavelength conversion device according to Claim 1, wherein said optical wavelength filter is

configured using an optical fiber grating, and by arranging serially an optical circulator and optical wavelength filter.

14. The wavelength conversion device according to Claim 1, wherein said optical wavelength filter is configured using an optical fiber grating, and by arranging optical circulators and optical wavelength filters serially and alternately.

15. The wavelength conversion device according to Claim 1, wherein said optical wavelength filter is an arrayed waveguide grating.